

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) SMC 60364/WO

Box No. I TITLE OF INVENTION

Ink Receptive Substrates

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Avecia Limited
Hexagon House
Blackley
Manchester M9 8ZS
United Kingdom

☐ This person is also inventor.

Telephone No.

0161 740 1460

Facsimile No.

0161 721 5801

Teleprinter No.

State (that is, country) of nationality:

GB

State (that is, country) of residence:

GB

This person is applicant
for the purposes of:

☐

all designated
States

☒

all designated States except
the United States of America

☐

the United States
of America only

☐

the States indicated in
the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ANNABLE, Tom
PO Box 42, Hexagon House
Blackley
Manchester M9 8ZS
United Kingdom

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box
is marked, do not fill in below.)

State (that is, country) of nationality:

GB

State (that is, country) of residence:

GB

This person is applicant
for the purposes of:

☐

all designated
States

☐

all designated States except
the United States of America

☒

the United States
of America only

☐

the States indicated in
the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf
of the applicant(s) before the competent International Authorities as:

☒

agent

☐

common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

MAYALL, John
Intellectual Property Group
Avecia Limited
PO Box 42, Hexagon House
Blackley
Manchester M9 8ZS
United Kingdom

Telephone No.

0161 721 1794

Facsimile No.

0161 721 5801

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

PADGET, John Christopher

21 Fieldway
Frodsham
Cheshire
WA60 6RO
United Kingdom

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
GB

State (that is, country) of residence:
GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and or (further) inventors are indicated on another continuation sheet

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked).

Regional Patent

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input checked="" type="checkbox"/> AE United Arab Emirates | <input checked="" type="checkbox"/> LR Liberia |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MA Morocco |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BR Brazil | |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CR Costa Rica | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CZ Czech Republic | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DK Denmark | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> DM Dominica | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia |
| <input checked="" type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> TZ United Republic of Tanzania |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IN India | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IS Iceland | |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input checked="" type="checkbox"/> ZA South Africa |
| | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KR Republic of Korea | Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet: |
| <input checked="" type="checkbox"/> KZ Kazakhstan | <input checked="" type="checkbox"/> DZ Algeria |
| <input checked="" type="checkbox"/> LC Saint Lucia | <input checked="" type="checkbox"/> X MZ Mozambique |
| <input checked="" type="checkbox"/> LK Sri Lanka | <input checked="" type="checkbox"/> AG Antigua and Barbuda |

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

Supplemental Box. If the Supplemental Box is not used, this sheet should not be included in the request.

1. If, in any of the Boxes, **the space is insufficient** to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:

- (i) **if more than two persons are involved as applicants and/or inventors** and no "continuation sheet" is available; in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;
- (ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "**the States indicated in the Supplemental Box**" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;
- (iii) if, in Box No. II or in any of the sub-boxes of Box No. III, **the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America**: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;
- (iv) if, in addition to the agent(s) indicated in Box No. IV, there are **further agents**: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;
- (v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "**patent of addition**," or "**certificate of addition**," or if, in Box No. V, the name of the United States of America is accompanied by an indication "**continuation**" or "**continuation-in-part**": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;
- (vi) if, in Box No. VI, there are **more than three earlier applications whose priority is claimed**: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;
- (vii) if, in Box No. VI, **the earlier application is an ARIPO application**: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.

2. If, with regard to the **precautionary designation statement** contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.

3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning **non-prejudicial disclosures or exceptions to lack of novelty**: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.

Continuation of Box IV

FAWKES, David Melville
NELSON, Michael Andrew
PUGSLEY, Roger Graham
REVELL, Christopher
SCHMITT, Maja
SHELLER, Alan

All of Intellectual Property Group, Avecia Limited, PO Box 42, Hexagon House, Blackley, Manchester M9 8ZS, United Kingdom

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claim indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 22/06/1999 22 June 1999	9914447.9	GB		
item (2) 24/03/2000 22 March 2000	0007277.7	GB		
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 2

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(iv)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA)
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / EPO

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 05

description (excluding sequence listing part) : 17

claims : 02

abstract : 01

drawings : 00

sequence listing part of description : 00

Total number of sheets : 25

This international application is accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other (specify):

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: ENGLISH

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

For Avecia Limited, ANNABLE, T and PADGET, JC.



MAYALL, John

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings: <input type="checkbox"/> received <input type="checkbox"/> not received
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau

PCT

FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's
file reference

SMC 60364/00

Applicant

Avecia Limited

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE

55.00

T

2. SEARCH FEE

~~638.00~~

S

International search to be carried out by

EPO

605.00

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains 25 sheets.

first 30 sheets

264.00

b1

x

remaining sheets

additional amount

b2

Add amounts entered at b1 and b2 and enter total at B

264.00

B

Designation Fees

The international application contains ALL designations.

8

x

56

448.00

D

number of designation fees
payable (maximum 8)

amount of designation fee

Add amounts entered at B and D and enter total at I

712.00

I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable)

44.00

P

5. TOTAL FEES PAYABLE

~~1149.00~~

1179.00

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☒ authorization to charge
deposit account (see below)

☐ bank draft

☐ coupons

☐ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO: GB

☒

is hereby authorized to charge the total fees indicated above to my deposit account.

☒

(this check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☒

is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account

D02944

7 June 2000

C. Terry

Deposit Account No

Date (day month year)

Signature

227
defect
debited
from dep
acc

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SMC 60364/WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/02212	International filing date (day/month/year) 08/06/2000	Priority date (day/month/year) 22/06/1999
International Patent Classification (IPC) or national classification and IPC B41M5/00		
Applicant AVECIA LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 08/12/2000	Date of completion of this report 20.02.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Spyropoulou, E Telephone No. +49 89 2399 2843 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02212

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-17 as originally filed

Claims, No.:

1-20 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02212

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-20
	No: Claims
Inventive step (IS)	Yes: Claims 1-20
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-20
	No: Claims

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02212

V.

The most relevant citation is US-A-4877688 (D1) which is a document mentioned in the description of the present application page 2 lines 22-23.

The ink receptive substrate according to claim 1 differs from the disclosure of D1 in that the porous polymer layer on the support material is obtained by polymerisation of a microemulsion on the support material wherein the microemulsion comprises a co-polymerisable surfactant.

Microemulsions are distinguished from conventional emulsions by their optical clarity, low viscosity, small domain size and thermodynamic stability. Conventional emulsions settle into discrete layers over time and are generally cloudy, of high viscosity, large domain size and low thermodynamic stability, see description page 2, lines 30-33.

None of the available citations discloses or suggests the use of a polymerized microemulsion to form a porous polymer layer on the support material in order to produce an ink receptive substrate having the advantages mentioned on page 12 lines 26-30 of the description and Tables 4-6 on pages 15 and 16, namely to benefit from fast drying times, avoidance of flammable and toxic organic solvents and good drop definition with little side-ways spread of the image. Furthermore because inks are fixed in the capillaries of the micro-porous layer, an excellent durable resolution capability of the substrate may be achieved.

The ink receptive substrate of the present application is used in all presently known recording technologies mentioned in the description page 12 lines 31-36.

An ink receptive substrate according to claim 1, a process for preparing said ink receptive substrate according to claim 14 and a kit comprising said ink receptive substrate are therefore novel and involve an inventive step.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02212

VIII.

a). In the independent claim 1 it is mentioned that the microemulsion comprises a co-polymerisable surfactant.

In claim 19 however this apparently essential feature is missing (see PCT/GL/3 4.4), resulting thus to an inconsistency among the independent claims.

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 29 January 2001 (29.01.01)	
International application No. PCT/GB00/02212	Applicant's or agent's file reference SMC 60364/WO
International filing date (day/month/year) 08 June 2000 (08.06.00)	Priority date (day/month/year) 22 June 1999 (22.06.99)
Applicant ANNABLE, Tom et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 08 December 2000 (08.12.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Olivia TEFY Telephone No. (41-22) 338.83.38
--	--

INTERNATIONAL SEARCH REPORT

International Application No.

PC 00/02212

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B41M5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 877 688 A (SENOO HIDEAKI ET AL) 31 October 1989 (1989-10-31) cited in the application column 2, line 33 -column 6, line 14 examples ---	1, 14, 19
A	EP 0 872 761 A (WACKER CHEMIE GMBH) 21 October 1998 (1998-10-21) page 2, line 40 -page 3, line 43 examples ---	1, 14, 19
A	EP 0 767 071 A (OJI PAPER CO) 9 April 1997 (1997-04-09) page 2, line 57 -page 4, line 57 examples --- -/--	1, 14, 19



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

17 August 2000

Date of mailing of the international search report

05/09/2000

Name and mailing address of the ISA

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NL - 2280 HV Rijswijk
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Fax (+31-70) 340-3016

Authorized officer

Markham, R

INTERNATIONAL SEARCH REPORT

International Application No

PO B 00/02212

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 04, 31 March 1998 (1998-03-31) & JP 09 309260 A (NIPPON PAPER IND CO LTD), 2 December 1997 (1997-12-02) abstract ---	1, 14, 19
A	DATABASE WPI Section Ch, Week 199805 Derwent Publications Ltd., London, GB; Class A97, AN 1998-047023 XP002145154 & JP 09 296067 A (NIPPON SHOKUBAI CO LTD), 18 November 1997 (1997-11-18) abstract -----	1, 14, 19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PO 08 00/02212

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4877688	A	31-10-1989	JP 1902382 C	08-02-1995
			JP 6030952 B	27-04-1994
			JP 63207681 A	29-08-1988
EP 0872761	A	21-10-1998	DE 19716350 A	22-10-1998
			DE 59800042 D	09-12-1999
			JP 2973399 B	08-11-1999
			JP 10301221 A	13-11-1998
			US 5922789 A	13-07-1999
EP 0767071	A	09-04-1997	JP 9099633 A	15-04-1997
			DE 69606369 D	02-03-2000
JP 09309260	A	02-12-1997	NONE	
JP 9296067	A	18-11-1997	NONE	

PCT

09/980,716

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SMC 60364/WO	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/02212	International filing date (day/month/year) 08/06/2000	(Earliest) Priority Date (day/month/year) 22/06/1999
Applicant AVECIA LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of **03** sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant

☐ because the applicant failed to suggest a figure

☐ because this figure better characterizes the invention

☐ None of the figures

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 00/02212

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B41M5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 877 688 A (SENOO HIDEAKI ET AL) 31 October 1989 (1989-10-31) cited in the application column 2, line 33 -column 6, line 14 examples	1,14,19
A	EP 0 872 761 A (WACKER CHEMIE GMBH) 21 October 1998 (1998-10-21) page 2, line 40 -page 3, line 43 examples	1,14,19
A	EP 0 767 071 A (OJI PAPER CO) 9 April 1997 (1997-04-09) page 2, line 57 -page 4, line 57 examples	1,14,19
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"Z" document member of the same patent family

Date of the actual completion of the international search

17 August 2000

Date of mailing of the international search report

05/09/2000

Name and mailing address of the ISA

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Fax: +31 70 340 0316

Authorizing Officer

Markham, R

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 00/02212

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 04, 31 March 1998 (1998-03-31) & JP 09 309260 A (NIPPON PAPER IND CO LTD), 2 December 1997 (1997-12-02) abstract ---	1, 14, 19
A	DATABASE WPI Section Ch, Week 199805 Derwent Publications Ltd., London, GB; Class A97, AN 1998-047023 XP002145154 & JP 09 296067 A (NIPPON SHOKUBAI CO LTD), 18 November 1997 (1997-11-18) abstract -----	1, 14, 19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02212

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4877688 A	31-10-1989	JP 1902382 C	08-02-1995
		JP 6030952 B	27-04-1994
		JP 63207681 A	29-08-1988
EP 0872761 A	21-10-1998	DE 19716350 A	22-10-1998
		DE 59800042 D	09-12-1999
		JP 2973399 B	08-11-1999
		JP 10301221 A	13-11-1998
		US 5922789 A	13-07-1999
EP 0767071 A	09-04-1997	JP 9099633 A	15-04-1997
		DE 69606369 D	02-03-2000
JP 09309260 A	02-12-1997	NONE	
JP 9296067 A	18-11-1997	NONE	

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SMC 60364/WO	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/02212	International filing date (day/month/year) 08/06/2000	Priority date (day/month/year) 22/06/1999
International Patent Classification (IPC) or national classification and IPC B41M5/00		
Applicant AVECIA LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 08/12/2000	Date of completion of this report 20.02.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Spyropoulou, E Telephone No. +49 89 2399 2843 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02212

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-17 as originally filed

Claims, No.:

1-20 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02212

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-20
	No: Claims
Inventive step (IS)	Yes: Claims 1-20
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-20
	No: Claims

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

V.

The most relevant citation is US-A-4877688 (D1) which is a document mentioned in the description of the present application page 2 lines 22-23.

The ink receptive substrate according to claim 1 differs from the disclosure of D1 in that the porous polymer layer on the support material is obtained by polymerisation of a microemulsion on the support material wherein the microemulsion comprises a co-polymerisable surfactant.

Microemulsions are distinguished from conventional emulsions by their optical clarity, low viscosity, small domain size and thermodynamic stability. Conventional emulsions settle into discrete layers over time and are generally cloudy, of high viscosity, large domain size and low thermodynamic stability, see description page 2, lines 30-33.

None of the available citations discloses or suggests the use of a polymerized microemulsion to form a porous polymer layer on the support material in order to produce an ink receptive substrate having the advantages mentioned on page 12 lines 26-30 of the description and Tables 4-6 on pages 15 and 16, namely to benefit from fast drying times, avoidance of flammable and toxic organic solvents and good drop definition with little side-ways spread of the image. Furthermore because inks are fixed in the capillaries of the micro-porous layer, an excellent durable resolution capability of the substrate may be achieved.

The ink receptive substrate of the present application is used in all presently known recording technologies mentioned in the description page 12 lines 31-36.

An ink receptive substrate according to claim 1, a process for preparing said ink receptive substrate according to claim 14 and a kit comprising said ink receptive substrate are therefore novel and involve an inventive step.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02212

VIII.

a). In the independent claim 1 it is mentioned that the microemulsion comprises a co-polymerisable surfactant.

In claim 19 however this apparently essential feature is missing (see PCT/GL/3 4.4), resulting thus to an inconsistency among the independent claims.

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 December 2000 (28.12.2000)

PCT

(10) International Publication Number
WO 00/78553 A1

- (51) International Patent Classification⁷: **B41M 5/00**
- (21) International Application Number: **PCT/GB00/02212**
- (22) International Filing Date: **8 June 2000 (08.06.2000)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data:
9914447.9 22 June 1999 (22.06.1999) **GB**
0007277.7 24 March 2000 (24.03.2000) **GB**
- (71) Applicant (for all designated States except US): **AVECIA LIMITED** [GB/GB]; Hexagon House, Blackley, Manchester M9 8ZS (GB).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **ANNABLE, Tom** [GB/GB]; P.O. Box 42, Hexagon House, Blackley, Manchester M9 8ZS (GB). **PADGET, John, Christopher** [GB/GB]; 21 Fieldway, Frodsham, Cheshire WA60 6RO (GB).
- (74) Agents: **MAYALL, John** et al.; Intellectual Property Group, Avecia Limited, P.O. Box 42, Hexagon House, Blackley, Manchester M9 8ZS (GB).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Published:**
— With international search report.
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **INK RECEPTIVE SUBSTRATES**

(57) Abstract: An ink receptive substrate comprising: (i) a support material; and (ii) a porous polymer layer on the support material obtained by polymerisation of a microemulsion on the support material; wherein the microemulsion comprises a co-polymerisable surfactant. Also claimed is a process for preparing an ink receptive substrate carrying a desired image and a kit for printing the substrate with ink.

WO 00/78553 A1

INK RECEPTIVE SUBSTRATES

This invention relates to ink receptive substrates and to processes for their preparation and use, particularly in the field of ink jet printing.

In recent years there have been advances in printing technology that permit the production of high resolution colour images through ink jet printing. These advances make it possible for a user to record a colour image in a digital format, transfer the image to a computer, manipulate the image, and then print the image using an ink jet printer. Current digital imaging systems are now capable of producing near photographic quality colour images.

Improvements in the quality of colour images produced by ink jet printers have resulted from developments in the components of the ink jet printer, such as printing heads, as well as advances in the ink compositions used in the ink jet printers. As a result of these developments in colour ink jet printing, a new factor limiting the resolution and appearance of colour images produced by ink printers has emerged. This limiting factor is the ink receptive substrate on which the image is printed.

Use of uncoated paper as the substrate for ink jet printing produces less than optimum resolution because fibres in the paper cause the ink to "run" sideways. Additionally, uncoated papers are typically not glossy and therefore do not give photographic quality output.

In an attempt to improve the performance of paper used with ink jet printers, some manufacturers extrude a plastic layer on the surface of the paper. The extruded plastic layer can give enhanced gloss, smoothness, and general appearance and is typically coated with materials that help to prevent the ink from running.

A drawback of extruded plastic paper coatings is that they typically have little or no porosity or liquid absorptivity. Consequently, the surface of these papers remain wet to the touch for an extended period of time because the ink drying mechanism is mainly due to evaporation of the ink solvent. It may take ten minutes or more for the images to completely dry, depending on the temperature and humidity. Because of this lengthy drying time, each printed sheet must be removed from the printer tray and set out to dry to prevent smudging or carryover of the printed image onto the back side of the next printed sheet. Also, this extended period of wet ink on the paper surface makes it more likely that the ink will run, lowering image quality.

Another attempt to improve the performance of paper used with ink jet printers involves placing a coating containing a porous mineral on a support medium. The porous mineral enhances ink absorption and thereby reduces the ink dry times. For example U.S. 4,780,356 discloses a porous membrane coated ink absorbent paper created by

coating a mineral/binder combination on paper, in which the mineral particles themselves can absorb the ink.

U.S. 5,104,730 describes forming a silica layer on top of a porous coating, which is fabricated from porous particles in a polymeric binder. U.S. 5,264,275, discusses forming a two-layer coating in which a lower layer has a smaller pore size and an upper layer has a larger pore size.

U.S. 5,463,178 discloses forming a porous coating from pseudo-boehmite and then applying a scratch resistant uppermost layer of silica gel. U.S. 5,472,773 describes producing a high gloss porous coated paper by first casting a porous layer from a pseudo-boehmite containing liquid on a smooth plastic sheet. A paper backing is then applied to the porous layer. Finally, the plastic sheet is separated from the porous layer to reveal the coated paper.

Others have found that ink absorbent coatings for ink jet recording media can be prepared using coatings that are free from inorganic filler particles. For example U.S. 5,374,475 describes preparing a polymeric solution and then adding a non-solvent to create microscopically small polymer particles. This polymer solution containing the microscopically small polymer particles is cast on a support media and then heat-treated to evaporate the solvents. U.S. 5,759,639 describes membrane coated substrates prepared by a phase inversion technique which entails coating a polymeric dope solution onto a substrate. The coated substrate is then quenched in a non-solvent, such as water, to produce a microporous structure.

U.S. 4,877,688 describes ink receptive coatings prepared by applying a pre-polymerised emulsion polymer to a transparent support.

According to the present invention there is provided an ink receptive substrate comprising:

- (i) a support material; and
- (ii) a porous polymer layer on the support material obtained by polymerisation of a microemulsion on the support material;

wherein the microemulsion comprises a co-polymerisable surfactant.

Microemulsions are distinguished from conventional emulsions by their higher optical clarity, low viscosity, small domain size and thermodynamic stability. Conventional emulsions settle into discrete layers over time and are generally cloudy, of high viscosity, large domain size and low thermodynamic stability.

The microemulsion is preferably a polymerisable oil-in-water, water-in-oil, oil-in-oil or more preferably a bicontinuous microemulsion. In bicontinuous microemulsions, an organic liquid forms a first continuous phase, an immiscible second liquid forms a second continuous phase and the phases are intermingled such that the properties hereinbefore ascribed to a microemulsion are observed. Preferred bicontinuous microemulsions

comprise an aqueous phase, one or more addition-polymerisable water-immiscible organic materials (hereinafter referred to for convenience as "polymerisable oil") and one or more surfactants.

The immiscible second liquid is preferably an aqueous phase, typically water optionally containing a solute. The solute may be a liquid (for example a volatile organic solvent, e.g. propylene glycol, ethylene glycol monobutyl ether, diethylene glycol monobutyl ether or 2-(2-ethoxyethoxy)ethanol) or a solid, especially a water-soluble inorganic salt, e.g. NaCl, KCl, $\text{Al}_2(\text{SO}_4)_3$, CaSO_4 , MgSO_4 and mixtures thereof.

When the aqueous phase is water containing a solute the appropriate concentration of the solute therein may be found by simple experiment.

The microemulsion preferably comprises:

- (a) 5 to 95 parts, more preferably 10 to 80, especially 30 to 70 parts of aqueous phase;
 - (b) 1 to 75 parts, more preferably 10 to 70 parts, especially 15 to 50 parts of polymerisable oil; and
 - (c) 0.1 to 70 parts, more preferably 1 to 30 parts of co-polymerisable surfactant;
- wherein all parts are by weight and the number of parts (a) + (b) + (c) adds up to 100.

The above preference for the maximum amount of water being 80 or 70 parts arises because at higher levels of water the porous structure of the polymer layer formed from the microemulsion tends to collapse, thereby reducing the ability of the resultant media to absorb the ink.

The microemulsion preferably contains a free-radical initiator, although such an initiator may be omitted in circumstances where it is not necessary to initiate polymerisation of the microemulsion. For example, electron beam polymerisation of microemulsions may under some circumstances proceed without including a free-radical initiator in the microemulsion. When a free-radical initiator is present in the microemulsion it is preferably present in an amount of 0.01 to 10%, more preferably 0.1 to 5% by weight relative to the total weight of the microemulsion.

Further ingredients may be present in the microemulsion, e.g. biocides, organic solvents, fillers (e.g. porous fillers, including silicas and aluminas), colorants, mordants (especially a cationic compound because these have a strong affinity for anionic dyes), anti-oxidants, polymers (including water-soluble polymers such as polyvinyl pyrrolidone and polyvinyl alcohol), rheology modifiers, and UV-stabilisers, in addition to components (a) to (c).

Optionally the microemulsion contains a block copolymer comprising hydrophobic and hydrophilic units. The hydrophobic units are preferably polyalkane (especially poly C_{2-8} -alkane) or polystyrene. The hydrophilic units are preferably non-ionic units, more

preferably poly(alkylene oxide) units, especially poly(C₂₋₅-alkylene oxide) units, more especially poly(ethylene oxide) units.

The block copolymer preferably has a number average molecular weight of from 500 to 500,000, more preferably 1000 to 100,000, especially 1000 to 50,000.

5 Particularly preferred block copolymers comprising hydrophobic and hydrophilic units include poly(ethylenepropylene)-block-poly(ethylene oxide) block copolymers and poly(ethylethylene)-block-poly(ethylene oxide) block copolymers.

Suitable block copolymers comprising hydrophobic and hydrophilic units are described in Langmuir, 1999, 15, pp 6707-6711 and Macromolecules, 1996, 29, pp 6994-10 7002.

The preference for the presence of these block copolymers arises because they allow the microemulsion to be prepared using very low levels of the surfactant. There appears to be a synergistic effect resulting from the combined use of a surfactant and the block copolymer, the mechanism of which is not fully understood. As the surfactant is 15 usually the most expensive component of the microemulsion the presence of the block copolymer can result in large cost savings. The presence of large amounts of surfactant in some circumstances may have a detrimental effect on the coatings properties e.g. causing surface tack and haziness to the cured film.

In one embodiment the microemulsion is free from porous inorganic compounds. 20 The inherently porous nature of the polymer layer can make the presence of such compounds unnecessary.

The microemulsion is preferably applied to the support material by a coating method, for example by dipping, spraying, knife coating, rotogravure coating, reverse roller coating or the like. Preferably the microemulsion is photopolymerisable.

25 The microemulsion is preferably polymerisable by means of free-radical initiated polymerisation or by means of a polymerisation process which does not involve free-radical initiation. In any case, the microemulsion is preferably thermally or, more preferably, photo-polymerisable (including polymerisable by electron beam or gamma (e.g. Cobalt 60) irradiation). The preference for the microemulsion being photo- 30 polymerisable arises because this enables particularly fast formation of the porous polymer layer. Preferred polymerisation processes which do not involve free-radical initiation include cationic, anionic and condensation polymerisation. Interfacial polymerisation may also be used.

35 When it is desired to accelerate removal of water from the polymerised microemulsion this may be performed by the application of heat and/or a vacuum thereto. Heat may be applied by any suitable method, including microwave and infra red irradiation. If desired the rate of drying may be controlled by appropriate adjustment of the humidity.

As examples of suitable polymerisable oils (with which the co-polymerisable surfactant may co-polymerise) there may be mentioned inter alia ethylenically unsaturated compounds, including alkyl(meth)acrylates, optionally substituted styrenes, methacrylamides, allyl compounds, vinyl ethers, vinyl ketones, vinyl halides, olefins, unsaturated nitriles and mixtures comprising two or more of the foregoing. The polymerisable oils may also be polymerisable monomers which are not ethylenically unsaturated, either containing or free from ethylenically unsaturated compounds, especially when the polymerisation technique used to obtain the porous polymer layer from the microemulsion comprises electron beam polymerisation.

The polymerisable oil preferably contains one or more ethylenically unsaturated compounds which carry two or more (especially two to six) ethylenically unsaturated groups because this enables the microemulsion to form a cross-linked porous polymer layer with improved mechanical properties. The ethylenically unsaturated groups in such species may be the same as each other (as in diacrylates, triacrylates and divinyl compounds) or they may be different from each other (as in allyl (meth)acrylates). Examples of polymerisable oils which contain two or more ethylenically unsaturated groups include diallylphthalate, divinylbenzene, allyl (meth)acrylate, trimethylol propane tri(meth)acrylate, ethylene glycol di(meth)acrylate, 1,6 hexane diol di(meth)acrylate, dipropylene glycol di(meth)acrylate, diallyl benzene and urethane, polyester, alkyd and epoxy di- and poly-(meth)acrylates.

In one embodiment the polymerisable oil contains one or more ethylenically unsaturated compounds which carry a cationic or anionic group, in this way the cationic or anionic group is capable of forming an ionic bond with a colorant carrying the opposite charge with resultant improvements in the wet-fastness properties of the substrate. Cationic groups are preferred, especially optionally substituted ammonium groups, because these can improve the wet fastness of images on the substrate formed from commonly used anionic dyes due to the attraction between the positive and negative charges.

In one embodiment the alkyl(meth)acrylates contain less than twenty carbon atoms and in another they are oligomers carrying one or more (meth)acrylate groups. Examples of alkyl(meth)acrylates containing less than twenty carbon atoms include methyl acrylate, ethyl acrylate, n-propyl acrylate, isopropyl acrylate, n-butyl acrylate, isobutyl acrylate, sec-butyl acrylate, amyl acrylate, hexyl acrylate, 2-ethylhexyl acrylate, octyl acrylate, tert-octyl acrylate, 2-phenoxyethyl acrylate, di- and tripropylene glycol diacrylate, 2-chloroethyl acrylate, 2-bromoethyl acrylate, 4-chlorobutyl acrylate, cyanoethyl acrylate, 2-acetoxyethyl acrylate, dimethylaminoethyl acrylate, benzyl acrylate, methoxybenzyl acrylate, 2-chlorocyclohexyl acrylate, cyclohexyl acrylate, furfuryl acrylate, tetrahydrofurfuryl acrylate, phenyl acrylate, hydroxyethyl(methyl)acrylate,

hydroxypropyl(meth) acrylate, 5-hydroxypentyl acrylate, 2,2-dimethyl-3-hydroxypropyl acrylate, 2-methoxyethyl acrylate, 3-methoxybutyl acrylate, 2-ethoxyethyl acrylate, 2-isopropoxyethyl acrylate, 2-butyloxyethyl acrylate, 2-(2-methoxyethoxy)ethyl acrylate, 2-(2-butoxyethoxy)ethyl acrylate, 1-bromo-2-methoxyethyl acrylate, 1,1-dichloro-2-ethoxyethyl acrylate, methyl methacrylate, ethyl methacrylate, n-propyl methacrylate, isopropyl methacrylate, n-butyl methacrylate, isobutyl methacrylate, sec-butyl methacrylate, amyl methacrylate, hexyl methacrylate, cyclohexyl methacrylate, benzylmethacrylate, chlorobenzyl methacrylate, octyl methacrylate, N-ethyl-N-phenylaminoethyl methacrylate, 2-(3-phenylpropyloxy)ethyl methacrylate, dimethylaminophenoxyethyl methacrylate and furfuryl methacrylate.

Preferred oligomers carrying one or more (meth)acrylate groups have a number average molecular weight of from 200 to 50,000, more preferably from 500 to 10,000. Such oligomers are preferably urethanes, polyethers, polyesters, epoxys or alkyds or a hybrid thereof. These oligomers carrying (meth)acrylate groups have an advantage of low volatility, making preparation of the porous polymer layer easier and making them more environmentally friendly than volatile monomers.

Preferred optionally substituted styrenes include styrene, divinyl benzene, methylstyrene, dimethylstyrene, trimethylstyrene, ethylstyrene, diethylstyrene, isopropylstyrene, butylstyrene, hexylstyrene, cyclohexylstyrene, decylstyrene, chloromethylstyrene, trifluoromethylstyrene, ethoxymethylstyrene, acetoxymethylstyrene, methoxystyrene, 4-methoxy-3-methylstyrene, dimethoxystyrene, chlorostyrene, dichlorostyrene, trichlorostyrene, tetrachlorostyrene, pentachlorostyrene, bromostyrene, dibromostyrene, iodostyrene, trifluorostyrene and 2-bromo-4-tri-fluoromethylstyrene.

Preferred methacrylamides contain less than 12 carbon atoms. Examples include methylmethacrylamide, tert-butylmethacrylamide, tert-octylmethacrylamide, benzylmethacrylamide, cyclohexylmethacrylamide, phenylmethacrylamide, dimethylmethacrylamide, dipropylmethacrylamide, hydroxyethyl-N-methylmethacrylamide, N-methylphenylmethacrylamide, N-ethyl-N-phenylmethacrylamide and methacrylhydrazine.

Preferred allyl compounds include allyl acetate, allyl caproate, allyl caprylate, allyl laurate, allyl palmitate, allyl stearate, allyl benzoate, allyl acetoacetate, allyl lactate, allyloxyethanol, allyl butyl ether and allyl phenyl ether.

Preferred vinyl ethers contain less than 20 carbon atoms. Examples include methyl vinyl ether, butyl vinyl ether, hexyl vinyl ether, octyl vinyl ether, decyl vinyl ether, ethylhexyl vinyl ether, methoxyethyl vinyl ether, ethoxyethyl vinyl ether, chloroethyl vinyl ether, 1-methyl-2,2-dimethylpropyl vinyl ether, 2-ethylbutyl vinyl ether, hydroxyethyl vinyl ether and dimethylaminoethyl vinyl ether.

Preferred vinyl ketones contain less than 12 carbon atoms. Examples include methyl vinyl ketone, phenyl vinyl ketone and methoxyethyl vinyl ketone.

Preferred vinyl halides include vinyl chloride, vinylidene chloride and chlorotrifluoro ethylene.

5 Preferred olefins include unsaturated hydrocarbons having less than 20 carbon atoms. Examples include dicyclopentadiene, ethylene, propylene, 1-butene, 1-pentene, 1-hexene, 4-methyl-1-pentene, 1-heptene, 1-octene, 1-decene, 5-methyl-1-nonene, 5,5-dimethyl-1-octene, 4-methyl-1-hexene, 4,4-dimethyl-1-pentene, 5-methyl-1-hexene, 4-methyl-1-heptene, 5-methyl-1-heptene, 4,4-dimethyl-1-hexene, 5,5,6-trimethyl-1-heptene,
10 1-dodecene and 1-octadecene.

Preferred unsaturated nitriles include acrylonitrile and methacrylonitrile.

The preferred ethylenically unsaturated compounds are the alkyl (meth)acrylates containing less than 20 carbon atoms, especially those specifically listed above.

15 The temperature at which polymerisation is carried out may affect the structure of the porous polymer layer. It is often preferred that polymerisation is carried out at about room temperature, e.g. with a photo-initiator, to retain the desired porous structure. Occasionally the presence of a photoinitiator can cause a slight haziness in the microemulsion and such microemulsions are included within the scope of this invention.

20 It is often preferred that the polymerisable oil comprises more than one addition-polymerisable water-immiscible organic compound.

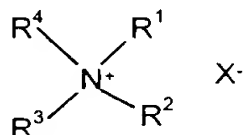
Preferably the polymerisation is performed under conditions such that the configuration of the microemulsion is retained during the polymerisation. Preferably a polymerisable oil is used which results in the porous layer having a T_g above room temperature and/or is cross-linkable with a suitable monomer in the reaction mixture used
25 in the method to give rigidity to the porous layer.

The co-polymerisable surfactant is preferably a non-ionic, anionic, zwitterionic or preferably cationic co-polymerisable surfactant, e.g. a quaternary ammonium compound or a tertiary amine salt.

30 The preference for cationic co-polymerisable surfactants arises because these result in porous layers with cationic groups having an affinity for anionic dyes commonly used in ink jet printing inks. In this way the wet-fastness properties of the substrate are enhanced by the attraction between the positive cationic groups in the porous layer and the negative anionic groups in the dye.

35 The co-polymerisable surfactant is co-polymerisable with itself and preferably with at least one other components of the polymerisable oil, for example the co-polymerisable surfactant is capable of grafting onto the polymerisable oil (e.g. by containing a hydrogen atom which is capable of being abstracted during free radical polymerisation) or it is an

addition-polymerisable surfactant. Preferred addition-polymerisable surfactants are of the general Formula:



wherein:

X^- is an anion;

R^1 and R^2 are each independently a C_{1-5} -alkyl group; and

R^3 and R^4 are each independently a C_{1-30} -alkyl group;

with the proviso that at least one of R^1 , R^2 , R^3 and R^4 carries an ethylenically unsaturated group.

X^- is preferably an inorganic anion, more preferably a halide and especially bromide or chloride.

R^1 and R^2 are preferably methyl.

R^3 is preferably C_{1-20} -alkyl.

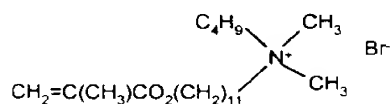
Preferably R^4 is a chain of from 5 to 15 carbon atoms, more preferably about eleven carbon atoms, bearing an ethylenically unsaturated group.

The ethylenically unsaturated group on the addition-polymerisable surfactant is preferably a (meth)acrylate, or an alternative olefinic group, e.g. an alkene or styrene.

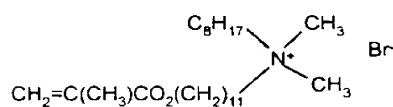
The ethylenically unsaturated group on the addition-polymerisable surfactant may be present adjacent the cation, where the surfactant is cationic, although it is often preferred that it is distant therefrom.

The addition-polymerisable surfactant will be chosen in the light of inter alia the chemical properties, particularly hydrophobicity, of the polymerisable oil. For example, as the polarity of the oil is decreased the hydrophobicity of the addition-polymerisable surfactant can often be increased. We have found that the following combinations of surfactant and polymerisable oil are particularly useful in the microemulsions:

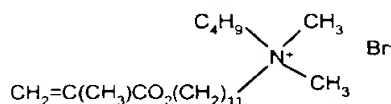
Surfactant	Polymerisable Oil
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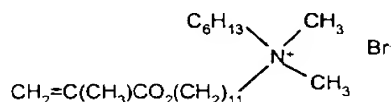
t-butyl methacrylate



dodecyl methacrylate



styrene



t-butyl-styrene

Whereas we do not exclude the possibility that the polymerisable oil and the addition-polymerisable surfactant may separately homopolymerise during preparation of the ink receptive substrate, it is preferred that they are co-polymerisable.

We do not exclude the possibility that a further surfactant which is non-polymerisable, e.g. $(\text{C}_{12}\text{H}_{25})_2\text{N}^+(\text{CH}_3)_2\text{Br}^-$, may be present. Preferred further surfactants are co-surfactants, especially linear alcohols, for example C_{4-20} -linear alcohols. Examples of preferred linear alcohols include decanol, octanol and pentanol. The identity and amount of the non-polymerisable surfactant will be chosen to ensure a microemulsion results. It is preferred that a major portion (i.e. more than 50% w/w) of the surfactant is polymerisable.

The free-radical initiator is preferably a photo-initiator, thermal-initiator, a redox initiator or combination thereof.

Preferred photo-initiators consist of a single compound or may comprise at least two components. Typically, the photo-initiator comprises any of the known photo-initiator systems which are used to initiate addition-polymerisation of polymerisable olefinically-unsaturated monomers. As examples of such compositions may be mentioned inter alia (a) mixtures of Michler's ketone and benzil or preferably benzophenone, typically in a weight ratio of about 1:4; (b) the coumarin-based photo-initiator systems described in U.S. Pat. No. 4,289,844; (c) combinations of hexaarylbisimidazoles and leuco dyes; (d) cyclohexadiene-leuco dye systems described in U.S. Pat. No. 4,241,869; (e) systems based on dimethoxyphenylacetophenone (benzil dimethyl ketal) and/or diethoxyacetophenone; or (f) preferably mixtures of amines and ketones as disclosed in UK Patent Specifications Nos 1,408,265 and 1,494,903, e.g. camphorquinone, flurenone or morpholine and N,N-dimethylaminoethyl methacrylate, typically in a weight ratio of about 1:1; (g) mixtures of (i) a light-sensitive initiator system, e.g. an α -diketone, a reducing agent capable of reducing the ketone when the latter is in an excited state, e.g. an organic amine, and (ii) a peroxide, as disclosed in European Patent Specifications Nos

0,059,649, and 0,090,493, the disclosures in which are incorporated herein by way of reference; e.g. a photo-initiator composition comprising camphorquinone, N,N'-dimethylaminoethyl methacrylate and tert-butyl perbenzoate, preferably in the weight ratio about 1:1:1; and (h) photo-initiators which generate acid when irradiated, e.g. aryl
5 diazonium compounds, diaryliodonium compounds, triaryl sulphonium and triaryl selenonium compounds.

The ketone may, for example, be present in the microemulsion in the concentration 0.1% to 2% by weight of the addition-polymerisable material therein although concentrations outside this range may be used if desired. Preferably the alpha-
10 diketone is present in a concentration of 0.1% to 1% by weight of the addition-polymerisable materials in the microemulsion.

The ketones are preferably soluble in the polymerisable material, and the above concentrations refer to solution concentrations.

Preferred thermal-initiators are organic peroxides and thermally decomposable
15 azo compounds, e.g. azo diisobutyronitrile. The organic peroxides, when present in the microemulsion, include those having the formula $R^5-O-O-R^5$ in which each R^5 independently is hydrogen, alkyl, aryl, or an acyl group, provided that no more than one of the R^5 groups is hydrogen. The term acyl means groups having the formula R^6-CO- in which R^6 is an alkyl, aryl, alkoxy or aryloxy group. The terms alkyl and aryl include
20 substituted alkyl and aryl.

Examples of organic peroxides suitable for use in the method of the present invention include diacetyl peroxide, dibenzoyl peroxide, ditertiary butyl peroxide, dilauroyl peroxide, tertiary-butyl perbenzoate, ditertiary-butyl-cyclohexyl perdicarbonate.

The organic peroxide may be, for example, present in the microemulsion in the
25 range 0.1% to 20%, preferably 0.5% to 5%, by weight of the polymerisable material in the microemulsion although concentrations outside this range may be used if desired.

The reactivity of a peroxide is often measured in terms of its half-life temperature, i.e. within ten hours at that temperature half of the oxygen has been made available. The peroxides suitable for use in the method according to the present invention preferably
30 have ten-hour half-life temperatures of less than 150 °C more preferably less than 110 °C.

According to a second aspect of the present invention there is provided a process for preparing an ink receptive substrate carrying a desired image comprising applying an ink to an ink receptive substrate to give the desired image, wherein the ink receptive substrate is as defined in the first aspect of the invention. The process for preparing an
35 ink receptive substrate carrying a desired image comprises the steps:

- (a) applying a polymerisable microemulsion to a support material;
- (b) polymerising the product of step (a) to give an ink receptive substrate; and
- (c) applying an ink to the ink receptive substrate to give the desired image;

wherein the microemulsion comprises a co-polymerisable surfactant.

The preferred microemulsions, support materials and substrates are as hereinbefore described in relation to the first aspect of the present invention.

The ink is preferably applied in step (c) by a printing method, more preferably by means of an ink jet printer.

The ink jet printer preferably applies an ink to the substrate in the form of droplets which are ejected through a small nozzle onto the substrate. Preferred ink jet printers are piezoelectric ink jet printers and thermal ink jet printers. In thermal ink jet printers, programmed pulses of heat are applied to the ink in a reservoir by means of a resistor adjacent to the nozzle, thereby causing the ink to be ejected in the form of small droplets directed towards the substrate during relative movement between the substrate and the nozzle. In piezoelectric ink jet printers the oscillation of a small crystal causes ejection of the ink from the nozzle.

In a preferred embodiment the product of step (b) is dried before performing step (c). Furthermore, further layers and treatments may be applied to the product of step (b) before and/or after step (c) has been performed, for example a scratch resistant layer.

The ink preferably comprises a colorant and a liquid medium. The ink may also be a liquid toner. Preferred colorants carry anionic groups, especially sulphonate and/or carboxylate groups. Preferred liquid media are water, organic solvent and mixtures comprising water and organic solvent.

The colorant is preferably yellow, magenta, cyan or black.

The colorant may be a single coloured component or a mixture of coloured components, for example it may be a mixture of different dyes. Preferred colorants are dyes, especially anionic dyes, and carbon black pigments (especially the chemically modified carbon black pigments carrying ionic groups available from Cabot Corporation). By using a mixture of different dyes as the colorant one may achieve greater flexibility in colour of the ink.

Useful classes of colorants include anthraquinones, phthalocyanines, pyrrolines, triphenodioxazines, methines, benzodifuranones, coumarins, idoanilines, benzenoids, xanthenes, phenazines, solvent soluble sulphur dyes, quinophthalones, pyridones, aminopyrazoles, pyrrolidines, styrylics and azoics. Examples of preferred azo colorants are monoazo, disazo and trisazo disperse dyes each, of which are optionally metallised and solvent soluble dyes; especially preferred azoics contain heterocyclic groups. The Colour Index International lists suitable colorants. Preferably the colorant carries one or more anionic groups.

Preferably the ink has been filtered through a filter having a mean pore size of less than $5\mu\text{m}$, more preferably less than $2\mu\text{m}$. A viscosity of less than 20cp, more preferably less than 10cp, at 20°C is preferred for the ink.

Preferably the ink receptive substrate has an overall thickness of less than 1cm, more preferably less than 2mm, especially less than 0.5mm.

Preferably the porous layer has a void volume of 5 to 75%, more preferably 10 to 60%.

5 The support material may itself comprise plurality of layers, adhesives and any other properties or features typically found in media. Multi-layer supports are commonly used in the art. In addition the ink receptive substrate may also carry one or more further layers, e.g. a scratch resistant layer, covering the porous polymer layer.

10 The ink receptive substrates may comprise several layers having differing mean pore sizes and/or void volumes. For example the outermost layer may have a larger mean pore size than the next layer. In this way the relatively large pores of the outermost layer can be made suitable for receiving pigment particles and the next layer is suitable for receiving dye. Furthermore, the ink receptive substrate may contain a further inner layer for receiving the liquid media of an ink to accelerate drying. This can be thought of
15 as a 'solvent sink' to make the media feel dry to the touch quickly and allow ink jet printers to work at high speed without printed substrates being smudged by subsequently printed substrates. Alternatively the substrate may be a fibrous absorbent material which acts a solvent sink.

20 The various layers of the ink receptive substrate may each independently be neutral, positively charged or negatively charged. Also the size of charge in the layers may be different, e.g. a slightly positive charge on the outer layer and a more positively charged next layer.

25 The support material is preferably a paper, extruded paper, an opaque or transparent film or foil, especially those made of polyester, polycarbonate, polypropylene, triacetate, polyvinylchloride, etc.

30 The ink receptive substrates of the invention benefit from fast drying times, avoidance of flammable and toxic organic solvents and good drop definition with little side-ways spread of the image. Furthermore, because inks are fixed in the capillaries of the micro-porous layer, an excellent, durable resolution capability of the substrate may be achieved.

35 The ink receptive substrate can be used for all presently known recording technologies (e.g. for posters, transparencies, photo-realistic printing, slides, etc.). The substrate can also be used, for instance, for a manual drawing, e.g. by a felt marker, ball-point writing utensil, by plotter apparatuses such as pin-plotters or ink jet-plotters or -printers, respectively, with CAD-recording apparatuses. The ink receptive substrate is particularly useful for photo-realistic printing, especially by ink jet.

In a third embodiment of the present invention there is provided a kit comprising:

- (i) an ink receptive substrate comprising a support material and a porous polymer, wherein the porous polymer layer has been obtained by polymerisation of a microemulsion; and
- (ii) written instructions to print the substrate with an ink.

5 Preferably the ink receptive substrate is as defined in the first aspect of the present invention.

Preferably the instructions are written on packaging containing the ink receptive substrate and/or on a sheet of paper accompanying the ink receptive substrate.

10 The written instructions are preferably for printing the substrate with an ink by means of an ink jet printer. The ink is preferably as hereinbefore described.

The following examples illustrate but do not limit the invention.

Examples 1 to 7 and Controls A to D

Step 1 - Preparation of Microemulsions and Control Examples

15 Microemulsions and Control Examples were prepared by adding the components indicated in Tables 1 to 4 to 14ml clear glass vials and subsequently rotating the vials on rollers for 24 hours.

20 The following abbreviations are used in Tables 1 to 3:

C3/11-M is butyldimethyl-[11-(2 methylacryloxy)undecyl]ammonium bromide

DPGDA is dipropyleneglycol diacrylate

HDDA is hexanediol diacrylate

25 C12/2-M is dodecyldimethyl-(2-isopropenyloxycarbonyl ether)ammonium bromide

AUMAB is trimethylammoniumundecylacrylate bromide

PUD is the potassium salt of undecanoic acid

Darocur™ 1173 is 2-hydroxy-2-methyl-1-phenyl propan-1-one (Darocur™ is a registered trade mark of Ciba Specialty Chemicals).

30 The composition of the microemulsions and Control Examples are shown in Tables 1 to 3 below.

Table 1

Component	Weight (g)		
	Example 1	Control A	Control B
C3/11-M	2.5	5.0	5.0
DPGDA	2.5		5.0
HDDA		5.0	
Water	5.0		
Darocur™ 1173	0.2	0.4	0.4

Table 2

Component	Weight (g)				
	Example 2	Example 3	Example 4	Example 5	Control C
HDDA	1.17	0.83	0.5	0.2	2.0
C12/2-M	5.83	4.17	2.5	1.0	
Water	3.0	5.0	7.0	8.8	
Darocur™ 1173	0.28	0.2	0.12	0.05	0.04

Table 3

Component	Weight (g)		
	Example 6	Example 7	Control D
AUMAB	2.17	1.90	
DPGDA	1.77	1.57	2.0
Water	0.99	1.48	
Darocur™ 1173	0.16	0.14	0.04

Step 2 - Preparation of Ink Receptive Substrates

The microemulsions and Control Examples prepared in step 1 were coated onto a support material (Melinex grade 505) using a Number 5 Meyer bar and then polymerised in a UV Parker box and finally dried in a vacuum oven at 60°C for 1 hour. The appearance of the initial microemulsion or control mixture and the resultant polymer layers is noted in Tables 5 to 8 below.

Step 3 - Ink Jet Printing the Ink Receptive Substrates

The ink receptive substrates resulting from Step 2 were printed on using a HP890 printer loaded with the standard aqueous inks containing anionic dyes and a black pigment ink. The printer was set at the HP transparency print setting. Dry-time was assessed by finger rub and scored according to the following scale:

Score	Dry-Time
5	<15s
4	15s-59s
3	1minute to 1 minute & 59 seconds
2	2-15 minutes
1	>15 -30 minutes
0	>30 minutes

The printed ink receptive substrates were left overnight then a small sample was taken and placed in water. The wet-fastness of the prints was noted after 4 hours (5 excellent, 0 poor). The prints were also assessed for print quality (5 excellent, 0 poor) by visual inspection.

The results of the tests described above on Examples 1 to 7 and Control Examples A to D are described in Tables 4 to 6 below.

Table 4

Example	Microemulsion Appearance	Film Appearance	Dry time	Print Quality	Print Appearance	Wet-fastness
1	slight haze #	clear	4	3	gloss	5
Control A	slight haze #	clear	1	3	gloss	4
Control B	slight haze #	clear	1	3	gloss	4

= slight haze caused by photoinitiator.

Table 5

Example	Microemulsion Appearance	Film Appearance	Dry time	Print Quality	Print Appearance	Wet-fastness
2	clear	translucent	0	1	slight gloss	4
3	clear	opaque	3	2	matt	5
4	clear	opaque	5	4	slight matt	5
5	clear	translucent	0	0	slight gloss	3
Control C	clear	clear	0	0	gloss	0

Table 6

Example	Microemulsion Appearance	Film Appearance	Dry time	Print Quality	Print Appearance	Wet-fastness
6	clear	translucent	1	3	gloss	4
7	clear	translucent	2	3	gloss	4
Control D	clear	clear	0	0	gloss	0

The results in Tables 4 to 6 show that the ink receptive substrates prepared using a microemulsion rather than an oil phase composition display significant advantages in their properties.

Example 9Step 1

A microemulsion was formed by mixing a surfactant (C3/11-M, 6g), polymerisable oil (DPGDA, 4g), water (10g) and a photo-initiator (Darocur™ 1173, 0.4g) until a fluid, transparent microemulsion was formed. This was coated onto a support material (Melinex D706 film) using a No. 3 Wire K-bar to give a 20 micron thick wet film. The microemulsion was then polymerised using a Primarc Minicure UV Station (curing energy ~ 4Jm⁻²). The resulting material was a transparent, tack-free solid coated film. This was then dried under vacuo for 2 hours at 50°C to give an ink receptive substrate according to the invention.

Step 2 - Control

A mixture of C3/11-M (6g), DPGDA (4g) and Darocur™ 1173 (0.4g) (NB no water) was coated onto a support material and cured as described in step 1 above to form a control substrate for comparison purposes.

Step 3 Printing and Image Quality

A photographic image was then printed onto the two substrates resulting from Steps 1 and 2 using a HP 890 ink-jet printer loaded with the standard aqueous inks containing anionic dyes and a black pigment ink. The printer was set on the plain paper setting. Dry-time was assessed by finger rub, print quality by visual inspection and water resistance by running tap water over the films for 2 minutes (10= no colour loss evident, 0=colourant completely removed) using the methods described above. The following results were obtained for the substrates resulting from Steps 1 and 2:

	Dry-time (Sec)	Print Quality	Water Resistance
Step 1	<15	Excellent	10
Control (Step 2)	did not dry	Poor	0

CLAIMS

1. An ink receptive substrate comprising:
(i) a support material; and
5 (ii) a porous polymer layer on the support material obtained by polymerisation of a microemulsion on the support material;
wherein the microemulsion comprises a co-polymerisable surfactant.

10 2. A substrate according to claim 1 wherein the co-polymerisable surfactant comprises a ethylenically unsaturated compound which carries a cationic or anionic group.

15 3. A substrate according to claim 1 or 2 wherein the microemulsion comprises water, a polymerisable oil and the co-polymerisable surfactant.

4. A substrate according to any one of the preceding claims wherein the co-polymerisable surfactant is an addition-polymerisable surfactant.

20 5. A substrate according to any one of the preceding claims wherein the microemulsion is a polymerisable oil-in-water, water-in-oil or bicontinuous microemulsion.

6. A substrate according to any one of the preceding claims wherein the microemulsion is a polymerisable bicontinuous microemulsion.

25 7. A substrate according to any one of the preceding claims wherein the microemulsion is photopolymerisable.

8. A substrate according to any one of the preceding claims wherein the microemulsion contains a mordant.

30 9. A substrate according to any one of the preceding claims wherein the microemulsion contains a cationic surfactant.

35 10. A substrate according to any one of the preceding claims wherein the microemulsion comprises:

- (a) 5 to 95 parts of aqueous phase;
- (b) 10 to 70 parts of polymerisable oil; and
- (c) 0.1 to 70 parts of co-polymerisable surfactant;

wherein all parts are by weight and the number of parts (a)+(b)+(c) adds up to 100.

11. A substrate according to claim 10 wherein the microemulsion is free from porous inorganic compounds.

12. A substrate according to claim 10 or 11 wherein the surfactant is a cationic surfactant.

13. A substrate according to any one of the preceding claims wherein the microemulsion contains a block copolymer comprising hydrophobic and hydrophilic units.

14. A process for preparing an ink receptive substrate carrying a desired image comprising applying an ink to an ink receptive substrate to give the desired image, wherein the ink receptive substrate is as defined in any one of claims 1 to 13.

15. A process according to claim 14 for preparing an ink receptive substrate carrying a desired image comprising the steps:

- (a) applying a polymerisable microemulsion to a support material;
- (b) polymerising the product of step (a) to give an ink receptive substrate; and
- (c) applying an ink to the ink receptive substrate to give the desired image.

16. A process according to claim 15 wherein the ink is applied in step (c) by means of an ink jet printer.

17. A process according to claim 1 or 16 wherein the ink contains a yellow, magenta, cyan or black colorant.

18. A process according to claim 15, 16 or 17 wherein the microemulsion contains a cationic compound and the ink contains an anionic dye.

19. A kit comprising:

- (a) an ink receptive substrate comprising a support material and a porous polymer layer, wherein the porous polymer layer has been obtained by polymerisation of a microemulsion; and
- (b) written instructions to print the substrate with an ink.

20. A kit according to claim 19 where the substrate is as defined in any one of claims 1 to 13.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 00/02212

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B41M5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 877 688 A (SENOO HIDEAKI ET AL) 31 October 1989 (1989-10-31) cited in the application column 2, line 33 -column 6, line 14 examples	1, 14, 19
A	EP 0 872 761 A (WACKER CHEMIE GMBH) 21 October 1998 (1998-10-21) page 2, line 40 -page 3, line 43 examples	1, 14, 19
A	EP 0 767 071 A (OJI PAPER CO) 9 April 1997 (1997-04-09) page 2, line 57 -page 4, line 57 examples	1, 14, 19
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

17 August 2000

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INTERNATIONAL SEARCH REPORT

International Application No.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 04, 31 March 1998 (1998-03-31) & JP 09 309260 A (NIPPON PAPER IND CO LTD), 2 December 1997 (1997-12-02) abstract ---	1, 14, 19
A	DATABASE WPI Section Ch, Week 199805 Derwent Publications Ltd., London, GB; Class A97, AN 1998-047023 XP002145154 & JP 09 296067 A (NIPPON SHOKUBAI CO LTD), 18 November 1997 (1997-11-18) abstract -----	1, 14, 19

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Interr. Application No

PCT/GB 00/02212

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